PROPOSED
July 2003

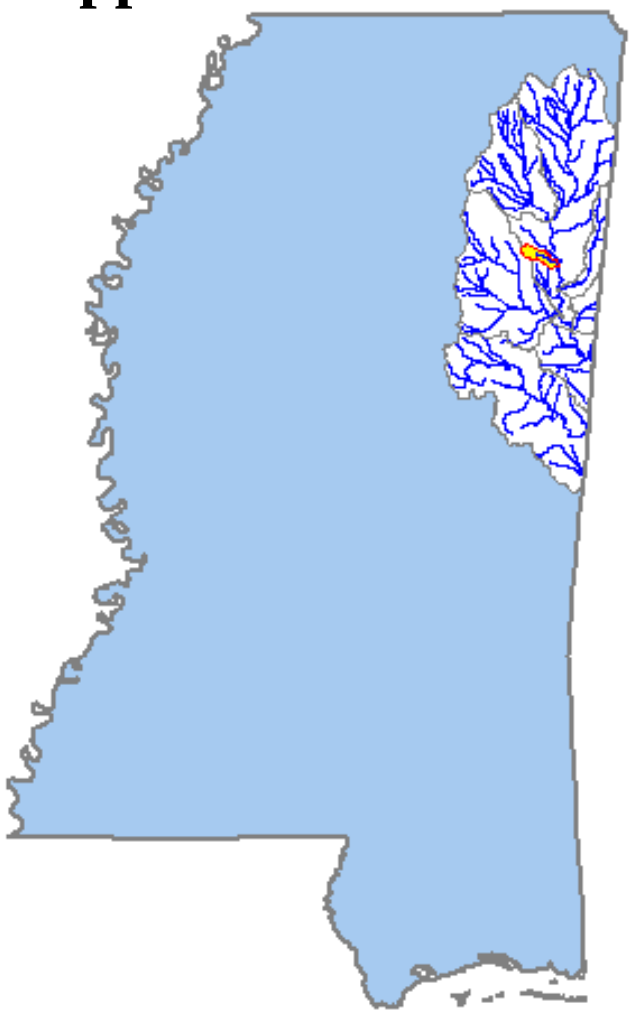
Total Maximum Daily Load

James Creek

Biological Impairment Due to Sediment

Tombigbee Basin

Monroe County, Mississippi



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FOREWORD

This report contains one or more Total Maximum Daily Loads (TMDLs) for water body segments found on Mississippi's 1996 Section 303(d) List of Impaired Waterbodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Conversion Factors

To convert from	To	Multiply by	To Convert from	To	Multiply by
acres	sq. miles	0.0015625	days	seconds	86400
cubic feet	cu. meter	0.028316847	feet	meters	0.3048
cubic feet	gallons	7.4805195	gallons	cu. feet	0.133680555
cubic feet	liters	28.316847	hectares	acres	2.4710538
cfs	gal/min	448.83117	miles	meters	1609.344
cfs	MGD	0.6463168	mg/l	ppm	1
cubic meters	gallons	264.17205	: g/l * cfs	gm/day	2.45
cubic meters	liters	1000	: g/l * MGD	gm/day	3.79

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	d	10	deka	da
10^{-2}	centi	c	10^{2}	hecto	h
10^{-3}	milli	m	10^{3}	kilo	k
10^{-6}	micro	:	10^{6}	mega	M
10^{-9}	nano	n	10^{9}	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

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TMDL INFORMATION PAGE

Listing Information

Name	ID	County	HUC	Cause	Mon/Eval
James Creek seg 1	MS009JM 1	Monroe	03160101	Biological Impairment due to Sediment	Monitored
At Aberdeen at Highway 25: From headwaters to former Vista Polymer outfall					
James Creek seg 2	MS009JM 2	Monroe	03160101	Biological Impairment due to Sediment	Monitored
At Aberdeen: From former Vista Polymer outfall to mouth at Tennessee-Tombigbee Waterway					
James Creek DA	MS009JE	Monroe	03160101	Sediment	Evaluated
Drainage Area near Aberdeen					

Water Quality Standard

Parameter	Beneficial use	Narrative Water Quality Criteria
Sediment	Aquatic Life Support	Waters shall be free from materials attributable to municipal, industrial, agricultural, or other dischargers producing color, odor, taste, total suspended solids, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses.

NPDES Facilities

There are no NPDES permits issued for facilities that discharge sediment in the watershed.

Total Maximum Daily Yield, MS009JM1, MS009JM2, and MS009JE

Segment	WLA (tons per acre per day)	LA (tons per acre per day)	MOS	TMDL (tons per acre per day)
MS009JM1	6.7E-03 to 1.7E-02*	6.7E-03 to 1.7E-02*	Implicit	6.7E-03 to 1.7E-02*
MS009JM2	6.7E-03 to 1.7E-02*	6.7E-03 to 1.7E-02*	Implicit	6.7E-03 to 1.7E-02*
MS009JE	6.7E-03 to 1.7E-02*	6.7E-03 to 1.7E-02*	Implicit	6.7E-03 to 1.7E-02*

* At the effective discharge based on Simon, et al. (2002) with a conversion factor from tonnes (T) to tons and from km2 to acres

EXECUTIVE SUMMARY

James Creek Segment 1 (MS009JM1) and James Creek Segment 2 (MS009JM2) are on the Mississippi 1998 Section 303(d) List of Impaired Waterbodies. James Creek Drainage Area (MS009JE) is on the Mississippi 1998 Section 303(d) List of Evaluated Water bodies. The two monitored segments were placed on the 1998 303(d) List for Biological Impairment. Biological Impairment is listed as a cause for water bodies in which at least one assemblage (fish, macroinvertebrates, or algae) indicates less than full support with moderate modification of the biological community noted. The drainage area was listed on the evaluated section of the 1998 303(d) List for unknown toxicity, pesticides, nutrients, and sediment. The evaluated causes were based on anecdotal information instead of monitoring data. Sediment is the only evaluated cause that will be addressed in this TMDL because it coincides with the cause determined for the monitored water bodies. MDEQ recognizes that contaminants may be associated with those sediments, but they are not being addressed in this TMDL. However, they would be controlled by the same best management measures that would control the sediment.

The pollutant of concern causing the biological impairment was determined to be sediment though field studies conducted in May 2001. Results indicate the biology is impaired. Sediment was identified as the cause of that biological impairment because the habitat was of only fair quality and there were no violations or significant departures from the conditions of the reference stream for any of the other physical and chemical water quality parameters. The comparison of the water quality data between 1978 and 2001 provided in Section 2.2 provides indication that the water quality for several parameters including dissolved oxygen, specific conductivity, ammonia, and pH have improved significantly since the removal of three point sources. Excessive sediment was identified as the cause of the degraded habitat, and thus the impaired biology, primarily through field investigation.

Photo 1. James Creek near mouth in winter of 2001

James Creek, Photo 1, is located in Monroe County near Aberdeen in the northeast part of Mississippi. James Creek lies within United States Geologic Service (USGS) Hydrologic Unit Code (HUC) 03160101 and the Southeastern Plains Ecoregion (65). Segment 1 is a six-mile segment near Highway 25 that begins at the headwaters and continues to the former Vista Polymer outfall. Segment 2 continues from the former Vista Polymer outfall for 8 miles, and ends at the mouth of the Tennessee-Tombigbee Waterway. The 27,676 acre watershed contains many landuse types including agricultural land, pastureland, and urban areas. However, the dominant landuses within the watershed are pasture and various row crops, corn, cotton, and soybeans. The town of Aberdeen is the only urban area within the watershed. Currently, there are no NPDES permitted dischargers located in the James Creek Watershed. Sediment loadings from NPDES regulated construction activities and Municipal Separate Storm Sewer Systems (MS4s) are considered point sources of sediment to surface waters. These discharges occur in response to storm events and are included in this TMDL as a part of the LA load with a yield of 1.7 to 4.2 tons per day per km^2 at the effective discharge. Construction of a highway bypass around Aberdeen adjacent to James Creek has been ongoing since 1987.

The State of Mississippi *Water Quality Criteria for Intrastate, Interstate and Coastal Waters* regulation does not include a numerical water quality standard for aquatic life protection due to sediment. The narrative standard for the protection of aquatic life is sufficient for justification of TMDL development, but does not provide a quantifiable TMDL. The Channel and Watershed Processes Research Unit (CWPRU) at the National Sedimentation Laboratory (NSL) was contracted by MDEQ to develop actual and reference sediment yields and loads for James Creek. The reference load, or TMDL, was obtained from the empirical analysis of historical flow and sediment-transport data for stable streams in the Southeastern Plains Ecoregion. The TMDL for James Creek is a weighted-reference condition based on the percentage of the drainage area encompassed by the various bed-material types.

According to 40 CFR §130.2 (i), TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure. In this case, an "other appropriate measure" is used to express the TMDL as the tons of sediment that can be discharged from an acre of a subwatershed during a day (tons/acre/day) at the effective discharge and still attain the applicable water quality standard. This results in a range of acceptable reference yields of 6.7E-03 to 1.7E-02 tons per acre per day at the effective discharge in the immediate watershed. It is expected that all values within this range will result in attainment of water quality standards. The TMDL is expressed at the effective discharge, which is the channel forming flow that moves the most sediment. This TMDL is not applicable on an annual basis, because the effective discharge only occurs statistically once every one and a half years, not on a daily basis. However, because the effective discharge is the critical condition, compliance with the TMDL at effective discharge will result in the attainment of the water quality standards at all times.

Wet weather sources of sediment, which are discharged to a receiving waterbody as a result of the storm events, are considered to be the primary concern for this sediment TMDL. These wet weather sources can be broadly defined, for the purposes of this TMDL, into two categories: wet weather sources regulated by the NPDES program, and wet weather sources *not* regulated by NPDES. Wet weather sources regulated by the NPDES program include industrial activities (which includes certain construction activities), and discharges from MS4s. The wet weather NPDES regulated sources are provided a wasteload allocation (WLA) in this TMDL, and all other wet weather sources of sediment (those not regulated by NPDES) are provided a Load Allocation (LA).

The WLAs provided to NPDES municipal and industrial permitted dischargers will be implemented through the State's NPDES permit program and are not included in this TMDL. The wet weather WLAs provided to the NPDES-regulated construction activities and MS4s will be implemented through Best Management Practices (BMPs) as specified in Mississippi's General Stormwater Permits for Small Construction, Construction, and Phase I & II MS4 permits, which can be found on the MDEQ website (www.deq.state.ms.us). It is not technically feasible to incorporate numeric sediment limits into permits for these activities/facilities at this time. LAs for non-point sources will be achieved through the voluntary application of BMPs. Properly designed and well-maintained BMPs are expected to provide attainment of the wet weather WLAs and LAs.

It is appropriate to apply the same target yield to permitted (WLA) and unpermitted (LA) watershed areas. For load TMDLs the WLA and LA are summed to calculate the TMDL. Because this TMDL is expressed as a yield, as long as all activities, permitted or unpermitted, meet the same yield, the TMDL will be met, regardless of the relative load contribution. The methods used to develop the acceptable yields are described in detail in the reports titled, *"Reference" and "Impacted" Rates of Suspended-Sediment Transport for Use in Developing Clean Sediment TMDLs: Mississippi and the Southeastern United States* (Simon, et al., 2002b) and *Actual and Reference Sediment Yields for the James Creek Watershed – Mississippi* (Simon, et al., 2002a).

The existing, or actual, sediment yield for James Creek was also estimated by the CWPRU using three mechanisms: simulations of flow and sediment transport using the model AnnAGNPS; direct comparisons of measured cross sections from 1967 and 2002; and by simulations of channel flow and sediment transport by the channel-evolution model CONCEPTS (Simon, et al., 2002a). AnnAGNPS is the Annualized Agricultural Non-Point Source Pollutant loading model, which is an advanced technological watershed evaluation tool to aid in the evaluation of watershed response to agricultural management practices. CONCEPTS is the Conservational Channel Evolution and Pollutant Transport System (Langendoen, 2000), which is a set of stream network, corridor, & water quality computer models designed to predict & quantify the effects of bank erosion & failures, bank mass wasting, bed aggradation & degradation, burial & re-entrainment of contaminants, and streamside riparian vegetation on channel morphology and pollutant loadings (Simon, et al., 2002a). AnnAGNPS modeling was conducted for the entire watershed in order to produce water and sediment loadings from tributaries and adjoining fields along the main channel used within CONCEPTS. Which was used to simulate the main channel. The refined-weighted median actual load at the effective discharge and at Highway 25 was estimated to be 3167.6 tons per day.

Results of the CWRPU study indicate that a significant proportion of the sediment in the James Creek watershed emanates from stream channels. Subsequent decisions regarding reducing sediment loadings will need to pay particular attention to stream-channel processes and stabilizing eroding reaches and tributaries of James Creek (Simon, et al., 2002a).

1.0 INTRODUCTION

1.1 Background

The identification of water bodies not meeting their designated use and the development of total maximum daily loads (TMDLs) for those water bodies are required by Section 303(d) of the Clean Water Act and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR part 130). The TMDL process is designed to restore and maintain the quality of those impaired water bodies through the establishment of pollutant specific allowable loads. The pollutant of concern for this TMDL is sediment as a cause of biological impairment.

James Creek was placed on the 1996 303(d) list based on data collected by MDEQ during a waste load allocation (WLA) study conducted at the Vista Polymers facility in 1992. The physical and chemical data from this study suggested that James Creek was impaired, to some degree, both upstream and downstream of the outfall. However, the dissolved oxygen levels were found to be significantly lower at the site located downstream of the outfall compared to the site located upstream of the outfall. MDEQ concluded that the poor water quality upstream of the outfall was likely due to nonpoint sources of pollution, while the poor water quality downstream was likely due to the effluent from the Vista Polymers facility. Since the 1992 study, Vista Polymers has moved their discharge to the Tennessee-Tombigbee Waterway. Two other NPDES permitted dischargers, the Aberdeen East POTW and Nanocor Inc. also moved their outfall locations from James Creek to the Tennessee-Tombigbee Waterway in 1999.

Based on the 1992 WLA study, James Creek, segment 1, was placed on the 1996 303(d) List for unknown toxicity, other habitat alterations, and suspended solids. James Creek, segment 1, was also listed for the causes of pesticides, nutrients, sediment, organic enrichment/low DO based on anecdotal 319 survey data. However, in 1998 all of these causes were replaced with biological impairment, which provides a more accurate description of the data on which the listings were based. Segment 2 of James Creek was placed in the 1996 303(d) List for unknown toxicity, pesticides, nutrients, sediment, organic enrichment/low DO, flow alteration, suspended solids. All of these causes except for flow alteration were also replaced with biological impairment on the 1998 303(d) List. Flow alteration, which was determined not to be a cause of impairment, was removed from the list in 1998. All of these delistings and replacements were included in a delisting package prepared by MDEQ and approved by EPA Region 4 on September 22, 1999. The sediment listing for the evaluated drainage area of James Creek, MS009JE, is also included in this TMDL.

The monitored segments are shown in Figure 1. James Creek is located in Monroe County near Aberdeen in the northeast part of Mississippi. James Creek lies within USGS HUC 03160101 and the Southeastern Plains Ecoregion (65). Segment 1 is a six-mile segment near Highway 25 that begins at the headwaters and continues to the former Vista Polymer outfall. Segment 2 continues from the former Vista Polymer outfall for 8 miles, and ends at the mouth at the Tennessee-Tombigbee Waterway. The 27,676 acre primarily agricultural watershed contains many landuse types, which are shown in Table 1. The town of Aberdeen is the only urban area within the watershed. Currently, there are no NPDES permitted dischargers located in the James Creek watershed. Construction of a highway bypass around Aberdeen adjacent to James Creek has been ongoing since 1987. The channel of James Creek has also been heavily affected by human intervention, including channelization in 1905, clearing and snagging in 1967, the construction of low-water

crossings, and the construction of the Tennessee-Tombigbee Waterway, which are all described in more detail by the CWPRU (Simon, et al., 2002a).

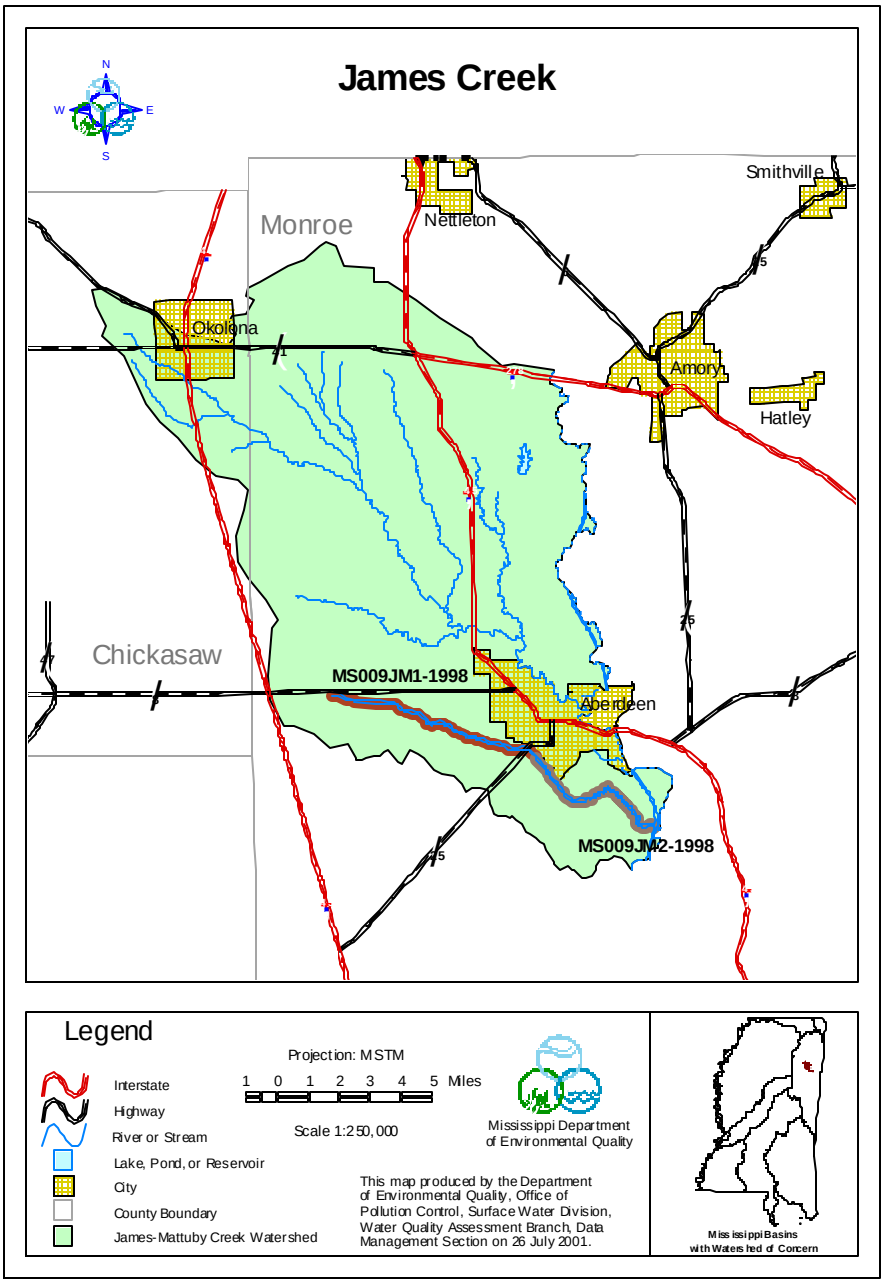

Figure 1. James Creek segments

Table 1. Landuse summary for the James Creek watershed (Simon, et al., 2002a)

	Corn	Cotton	Sorghum	Soybeans	Wheat	Pasture	Fallow	Forest	Urban	
Area (acres)	3,092	1,566	662	2,692	711	7,721	3,589	6,061	852	26,948
Percentage	11.5	5.8	2.5	10.0	2.6	28.7	13.3	22.5	3.2	100.0

1.2 Determination of Sediment as Pollutant of Concern

Because limited data are available on the instream sediment load, the determination of sediment as a cause is based primarily on field observation of sediment depostion issues related to habitat impairment in James Creek. The methods being utilized for the development of this TMDL are limited to sediment quantity estimates as is this TMDL. However, MDEQ recognizes that contaminants may be associated with those sediments. Associated contaminants, such as pesticides and nutrients, are not being addressed at this time because habitat problems due to sedimentation were identified as the cause of the biological impairment. It is assumed that any associated contaminants would be controlled by the same measures that would control the sediment called for by this TMDL. In addition, the data provided in Section 2.2 indicate an improvement in water quality for the parameters of dissolved oxygen, specific conductivity, ammonia, and pH as a result of the removal of point sources.

1.3 Applicable Water body Segment Use

The water use classification for James Creek, as established by the State of Mississippi in the *Water Quality Criteria for Intrastate, Interstate and Coastal Waters* regulation, is Fish and Wildlife Support. Waters with this classification are intended for fishing and propagation of fish, aquatic life, and wildlife. Waters that meet the Fish and Wildlife Support criteria should also be suitable for secondary contact, which is defined as incidental contact with water including wading and occasional swimming.

1.4 Applicable Water body Segment Standard

The *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* do not include a water quality standard applicable to aquatic life protection due to sediment. However, a narrative standard for the protection of aquatic life was interpreted to determine an applicable target for this TMDL. The narrative standard is that waters shall be free from materials attributable to municipal, industrial, agricultural, or other dischargers producing color, odor, taste, total suspended solids, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses.

2.0 TMDL ENDPOINT AND WATER QUALITY ASSESSMENT

2.1 Selection of a TMDL Endpoint and Critical Condition

One of the major components of a TMDL is the establishment of target endpoints, which are used to evaluate the attainment of acceptable water quality. Target endpoints, therefore, represent the water quality goals that are to be achieved by meeting the load and waste load allocations specified in the TMDL. The endpoints allow for a comparison between observed conditions and conditions that are expected to restore designated uses.

This sediment TMDL is expressed as an acceptable range of sediment yields at the effective discharge. The range was developed by the CWPRU from data measured at stable streams with a similar bed material in the same ecoregion as James Creek. The target range for the James Creek watershed is sediment yields in the range from 6.7E-03 tons of sediment per acre per day to 1.7E-02 tons of sediment per acre per day. The development of this acceptable loading range is described in detail by the CWPRU (Simon, et al., 2002a). The reduction of the sediment load in the James Creek watershed to equal that of a relatively stable stream should allow James Creek to become stable, which would provide improved habitat to allow the biology of James Creek to no longer be impaired.

The critical condition for biological impairment caused by sediment is the long-term accumulation of sediments in the stream habitat areas. The discharge which moves the most sediment is known as the effective discharge, which is the critical condition for this TMDL (Simon, et al., 2002a). The reference and actual loads are provided at Highway 25 instead of the mouth of James Creek in order to utilize measured flow data at that point. This area may also be a more representative reach of the watershed because the lower reach above the mouth at the Tennessee-Tombigbee Waterway is an unmodified, more sinuous reach that may be impacted by backwater from the Tennessee-Tombigbee Waterway. If the sediment target applicable for sediment in James Creek is maintained during critical conditions, then the health of the stream and its biological community should improve.

2.2 Discussion and Inventory of Instream Water Quality Data

In addition to the 1992 WLA investigation described in Section 1.1, there have been two additional water quality studies performed on James Creek. The first was conducted by the USGS in 1978 (Bednar, 1981). In this study, water quality parameters including dissolved oxygen, 5-day biochemical oxygen demand (BOD_5), and nutrients were sampled. The USGS study also included measurement of hydrological parameters including stream flow and channel dimensions. MDEQ personnel conducted the second water quality study in 2001.

The short-term water quality study of James Creek was conducted on November 14-16, 1978 by the USGS, during a period of low stream flow. During the study, which focused on a 2.6-mile section of James Creek, it was determined that high loads of nutrients and BOD_5 were due to effluents from point source dischargers. The study included data collection at three monitoring stations. Site 1 was located at the Highway 25 bridge. Sites 2 and 3 were both located downstream of Highway 25 at Darracott Road and an unnamed county road, respectively.

During the USGS study, there were three point source facilities discharging into James Creek; the Aberdeen East POTW, Nanocor Inc., and Vista Polymers. USGS concluded that the quality of water in James Creek was undesirable for many uses due to the point source dischargers in the system. Because groundwater inflow is minimal in the upstream reaches of James Creek, it was found that the quantity of streamflow in the reaches was primarily composed of discharge from the point sources. All three point sources removed their discharge in 1999.

The objective of the study performed by MDEQ on May 7–9, 2001 was to collect data reflecting the current biological, chemical, and physical condition of the creek (MDEQ, 2001). The data collection plan for this study was targeted to provide data to confirm whether or not James Creek was impaired and, if impairment was found, to determine the specific pollutant causing the impairment. Four monitoring sites were used during this study. Two of the sites were located on James Creek l; JMS1 at Highway 25 and JMS2 at Darracott Road, which are shown in Photo 2 and Photo 3, respectively. Additional sites were located on Spring Creek, a candidate reference stream, and Town Creek, a candidate stressor stream.

MDEQ assessed the data collected during this study and found that the biology was moderately impaired, while the chemistry was non-impaired. The physical data were assessed as fair, indicating that there was some degradation of the aquatic habitat. The combination of the poor biology and fair habitat, along with field observation, indicated that sediment is the cause of the biological impairment. Data collected during the study showed that there were no violations of Mississippi water quality standards for dissolved oxygen, specific conductivity, or pH. Also, none of the other chemical water quality parameters, including nutrients, were indicative of causing biological problems as compared to target values or the reference stream.

Photo 2. James Creek at Highway 25 (JMS1)

Photo 3. James Creek at Darracott Road (JMS2)

Comparison of the data collected in the USGS 1978 study with the MDEQ 2001 study shows a marked improvement in the water quality conditions in James Creek. Two of the stations, Site 2 from the 1978 study and JMS2 from the 2001 study are located at the same place, at Darracott Road. Thus, data collected from the two studies are comparable. Although the remaining stations from the two studies are not at the same location on James Creek, comparing the data still indicate an improvement in the general water quality condition of the system. Significantly, the minimum DO measured at Darracott Road improved from 0.4 mg/l at Site 2 (1978) to 6.77 mg/l at JMS2 (2001). Violations of the daily average DO standard were measured at all stations in 1978, while there were no violations in 2001. In addition, the concentrations of ammonia nitrogen and total phosphorous are generally lower in 2001. The data also show that the specific conductance of James Creek was lower in 2001, due to the removal of the point source discharges. Although the USGS data were collected during the month of November and the MDEQ data were collected during the month of May, seasonal variations should not limit comparisons of the data. The water temperatures are only slightly lower during the USGS study. In addition, both studies were performed during low-flow periods.

3.0 SOURCE ASSESSMENT AND MODELING PROCEDURE

The TMDL evaluation based on the CWPRU work is summarized in this report and examined the potential sources of sediment in the James Creek watershed. The source assessment was used as the basis of development for the models and should be the ultimate analysis of the TMDL allocation options. Sources were characterized with the best available information, which is documented in this section.

3.1 Assessment of Point Sources

There are no longer any waste water treatment facilities permitted to discharge in James Creek. However, sediment loadings from NPDES regulated construction activities and Municipal Separate Storm Sewer Systems (MS4s) are considered point sources of sediment to surface waters. These discharges occur in response to storm events and are included in the WLA of this TMDL.

As of March 2003, discharge of storm water from construction activities disturbing between one and five acres must also be authorized by an NPDES permit in addition to the requirements already in place for larger construction sites. The purpose of these NPDES permits is to eliminate or minimize the discharge of pollutants from construction activities. Since construction activities at a site are of a temporary, relatively short term nature, the number of construction sites covered by the general permit at any instant of time varies. The target for these areas is the same range as the TMDL target of 6.7E-03 to 1.7E-02 tons per acre per day at the effective discharge. The WLAs provided to the NPDES regulated construction activities and MS4s will be implemented as Best Management Practices (BMPs) as specified in Mississippi's General Stormwater Permits for Small Construction, Construction, and Phase I & II MS4 permits. It is not technically feasible to incorporate numeric sediment limits into construction storm water or MS4 permits at this time. WLAs should not be construed as numeric permit limits for construction or MS4 activities. Properly designed and well-maintained BMPs are expected to provide attainment of WLAs.

3.2 Assessment of Nonpoint Sources

Nonpoint loading of sediment in a water body results from the transport of the material into receiving waters by the processes of mass wasting, head cutting, gullying, and erosion. Sources of sediment include:

- Agriculture
- Silviculture
- Rangeland
- Roads
- Mass wasting areas
- Gullies
- Surface mining
- In-stream sources
- Historical land use activities and channel alterations

3.3 Linking the Sources to the Endpoint

As described in the Executive Summary and by the CWPRU AGNPS simulates loading from upland areas while CONCEPTS simulates loading from the channel (Simon, et al., 2002a). Detailed landuse distribution within the drainage basin is shown in Table 1. The development of the landuse information for the entire watershed is based on several sources and described in detail by the CWPRU (Simon, et al., 2002a).

Establishing the relationship between the target and the estimated source loading is a critical component of TMDL development. It allows for the evaluation of management options that will achieve the desired source loads. Ideally, the linkage will be supported by monitoring data that allow the TMDL developer to associate certain water body responses to flow and loading conditions. In this section, the selection of the modeling tools, setup, and model application are discussed.

The estimation of the actual sediment load for James Creek was developed using the complex computer simulation systems, AGNPS and CONCEPTS (Simon, et al., 2002a). The report titled, *Actual and Reference Sediment Yields for the James Creek Watershed – Mississippi* provides a detailed description of the model setup, load calculation methodology, and model results (Simon, et al., 2002a).

4.0 ALLOCATION

The allocation for this TMDL involves a waste load allocation (WLA) for permitted sources, a load allocation (LA) for unpermitted nonpoint sources, and an implicit margin of safety (MOS), which should result in attainment of water quality standards in James Creek. According to 40 CFR §130.2 (i), TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure. In this case, an "other appropriate measure" is used to express the TMDL as the tons of sediment that can be discharged from an acre of a subwatershed during a day (tons/acre/day) at the effective discharge and still attain the applicable water quality standard. It is appropriate to apply the same target yield to permitted (WLA) and unpermitted (LA) watershed areas. For load TMDLs the WLA and LA are summed to calculate the TMDL. Because this TMDL is expressed as a yield, as long as all activities, permitted or unpermitted, meet the same yield, the TMDL yield will be met, regardless of the relative load contribution. The methods used to develop these values are described in detail in the reports titled, *"Reference" and "Impacted" Rates of Suspended-Sediment Transport for Use in Developing Clean Sediment TMDLs: Mississippi and the Southeastern United States* (Simon, et al., 2002b) and *Actual and Reference Sediment Yields for the James Creek Watershed – Mississippi* (Simon, et al., 2002a).

4.1 Wasteload Allocations

Sediment loadings from NPDES regulated construction activities and Municipal Separate Storm Sewer Systems (MS4s) are considered point sources of sediment to surface waters. These discharges occur in response to storm events and are included in the WLA of this TMDL as the same target yield as the TMDL of 6.7E-03 to 1.7E-02 tons per acre per day at the effective discharge.

4.2 Load Allocations

The load allocation developed for this TMDL is an estimation of the contribution of all nonpoint sources in the watershed. As described by the CWPRU the relative contribution of actual sources in for the past ten years is approximately 70% channels; 30% uplands (Simon, et al., 2002a). Estimates of nonpoint sources were AGNPS and CONCEPTS results. Due to instability the channel is the major sediment producing area in the watershed, which indicates the need for streambank restoration as well as the reduction of the sediment load from upland sources (Simon, et al., 2002a). Best management practices (BMPs), as outlined in "Mississippi's BMPs: Best Management Practices for Forestry in Mississippi" (MFC, 2000), "Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater" (MDEQ, et. al, 1994), and "Field Office Technical Guide" (NRCS, 2000), would be the most effective means of reducing the load from the upland sources.

The calculated allowable range of loads of sediment that can be delivered into James Creek from it's watershed without exceeding the applicable narrative water quality standard, as interpreted by MDEQ, is 6.7E-03 to 1.7E-02 tons per acre per day at the effective discharge. These values were calculated from CWPRU (Simon, et al., 2002a) using a conversion factor from tonnes (T) to tons and square kilometers to acres.

4.3 Incorporation of a Margin of Safety (MOS)

The two types of MOS development are to implicitly incorporate the MOS using conservative model assumptions or to explicitly specify a portion of the total TMDL as the MOS. The MOS selected for this model is implicit. The use of conservative modeling procedures provides a sufficient implicit MOS.

4.4 Calculation of the TMDL

As stated above, the pollutant of concern for this TMDL is sediment from landuse runoff and in-channel processes. The load allocation includes the contributions from the channel and surface runoff from the watershed. The margin of safety for this TMDL is implicit and derived from the conservative assumptions incorporated into this methodology. This TMDL, expressed as an acceptable range of sediment yields, is the same for the WLA, LA, and TMDL. For load TMDLs the WLA and LA are summed to calculate the TMDL. Because this TMDL is expressed as a yield, as long as all activities, permitted or unpermitted, meet the same yield as shown in Table 5, the TMDL yield will be met, regardless of the relative load contribution.

WLA= 6.7E-03 to 1.7E-02 tons of sediment per acre per day at the effective discharge

LA = 6.7E-03 to 1.7E-02 tons of sediment per acre per day at the effective discharge

MOS = Implicit

Table 2. TMDL Yields

Parameter	WLA	LA	MOS	TMDL
Sediment (tons/acre/day)*	6.7E-03 to 1.7E-02	6.7E-03 to 1.7E-02	Implicit	6.7E-03 to 1.7E-02

*at the effective discharge

4.5 Seasonality

The use of a data collected throughout the period of record, which includes all seasons for several years, at many stations in the ecoregion to set the target addresses seasonal variation.

5.0 CONCLUSION

The acceptable range of sediment yields was found to be 6.7E-03 tons per acre per day to 1.7E-02 tons per acre per day at the effective discharge. It is important to consider that loading rates have been generally decreasing with time since 1968 (Simon, et al., 2002a). However, James Creek should still be considered a high priority for stream bank and riparian buffer zone restoration and any sediment reduction BMPs, especially for the road crossings, agricultural activities, and construction activities. The implementation of these activities should allow for the stream's habitat to be restored, and allow the biological community to reestablish.

5.1 Future Activities

MDEQ has adopted the Basin Approach to Water Quality Management, a plan that divides Mississippi's major drainage basins into five groups. During each yearlong cycle, MDEQ resources for water quality monitoring will be focused on one of the basin groups. During the next monitoring phase in the Tombigbee Basin, the James Creek watershed will receive additional monitoring to identify any changes or improvements in water quality. For land disturbing activities related to silviculture, construction, and agriculture, it is recommended that practices, as outlined in "Mississippi's BMPs: Best Management Practices for Forestry in Mississippi" (MFC, 2000), "Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater" (MDEQ, et. al, 1994), and "Field Office Technical Guide" (NRCS, 2000), be followed, respectively.

5.2 Public Participation

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in the statewide newspaper and a newspaper in the area of the watershed. The public will be given an opportunity to review the TMDL and submit comments. MDEQ also distributes all TMDLs at the beginning of the public notice to those members of the public who have requested to be included on a TMDL mailing list. TMDL mailing list members may request to receive the TMDL reports through either, email or the postal service. Anyone wishing to become a member of the TMDL mailing list should contact Greg Jackson at (601) 961-5098 or Greg_Jackson@deq.state.ms.us. At the end of the 30-day period, MDEQ will determine the level of interest in the TMDL and make a decision on the necessity of holding a public meeting.

All comments received during the public notice period and at any public meeting become a part of the record of this TMDL. All comments will be considered in the ultimate completion of this TMDL for submission of this TMDL to EPA Region 4 for final approval. Upon approval of this TMDL it will replace the TMDL proposed by EPA in June of 2002.

DEFINITIONS

Ambient stations: a network of fixed monitoring stations established for systematic water quality sampling at regular intervals, and for uniform parametric coverage over a long-term period.

Assimilative capacity: The capacity of a body of water or soil-plant system to receive wastewater effluents or sludge without violating the provisions of the State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters and Water Quality regulations.

Background: The condition of waters in the absence of man-induced alterations based on the best scientific information available to MDEQ. The establishment of natural background for an altered water body may be based upon a similar, unaltered or least impaired, water body or on historical pre-alteration data.

Bedload sediment: Portion of sediment load transported downstream by sliding, rolling, bouncing along the channel bottom. Generally consists of particles >1 mm.

Calibration: The process of adjusting model parameters within physically defensible ranges until the resulting predictions give a best possible good fit to observed data.

Channel: A natural stream that conveys water; a ditch or channel excavated for the flow of water.

Channel improvement: The improvement of the flow characteristics of a channel by clearing, excavation, realignment, lining, or other means in order to increase its capacity. Sometimes used to connote channel stabilization.

Channel stabilization: Erosion prevention and stabilization of velocity distribution in a channel using jetties, drops, revetments, vegetation, and other measures.

Clean sediment: Sediment that is not contaminated by chemical substances. Pollution caused by clean sediment refers to the quantity of sediment, as opposed to the presence of pollutant-contaminated sediment.

Critical Condition: Hydrologic and atmospheric conditions in which the pollutants causing impairment of a water body have their greatest potential for adverse effects.

Cross-sectional area: Wet area of a waterbody normal to the longitudinal component of the flow.

Daily discharge: The "discharge of a pollutant" measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily average" is calculated as the average.

Designated Use: Use specified in water quality standards for each water body or segment regardless of actual attainment.

Discharge monitoring report: Report of effluent characteristics submitted by a NPDES permitted facility.

Diurnal: Actions or processes that have a period or a cycle of approximately one tidal-day or are completed within a 24-hour period and that recur every 24 hours.

Dynamic model: A mathematical formulation describing and simulating the physical behavior of a system or a process and its temporal variability.

Ecoregion: A physical region that is defined by its ecology, which includes meteorological factors, elevation, plant and animal speciation, landscape position, and soils.

Effective Discharge: The discharge which moves the most sediment.

Effluent: Treated wastewater flowing out of the treatment facilities.

Effluent standards and limitations: All State or Federal effluent standards and limitations on quantities, rates, and concentrations of chemical, physical, biological, and other constituents to which a waste or wastewater discharge may be subject under the Federal Act or the State law. This includes, but is not limited to, effluent limitations, standards of performance, toxic effluent standards and prohibitions, pretreatment standards, and schedules of compliance.

Fluvial geomorphology: The effect of rainfall and runoff on the form and pattern of riverbeds and river channels.

Geomorphology: The study of the evolution and configuration of landforms.

Impaired Water body: Any water body that does not attain water quality standards due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment.

Land Surface Runoff: Water that flows into the receiving stream after application by rainfall or irrigation. It is a transport method for nonpoint source pollution from the land surface to the receiving stream.

Load allocation (LA): The portion of a receiving water's loading capacity attributed to or assigned to nonpoint sources (NPS) or background sources of a pollutant. The load allocation is the value assigned to the summation of all direct sources and land applied fecal coliform that enter a receiving water body.

Loading: The total amount of pollutants entering a stream from one or multiple sources.

Mass wasting: Downslope transport of soil and rocks due to gravitational stress.

Narrative criteria: Nonquantitative guidelines that describe the desired water quality goals.

Nonpoint Source: Pollution that is in runoff from the land. Rainfall, snowmelt, and other water that does not evaporate become surface runoff and either drains into surface waters or soaks into the soil and finds its way into groundwater. This surface water may contain pollutants that come from land use activities such as agriculture, construction, silviculture, surface mining, disposal of wastewater, hydrologic modifications, and urban development.

NPDES permit: An individual or general permit issued by the Mississippi Environmental Quality Permit Board pursuant to regulations adopted by the Mississippi Commission on Environmental Quality under Mississippi Code Annotated (as amended) §§ 49-17-17 and 49-17-29 for discharges into State waters.

Point Source: Pollution loads discharged at a specific location from pipes, outfalls, and conveyance channels from either wastewater treatment plants or industrial waste treatment facilities. Point sources can also include pollutant loads contributed by tributaries to the main receiving stream.

Pollution: Contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the State, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance, or leak into any waters of the State, unless in compliance with a valid permit issued by the Permit Board.

Sediment: Particulate organic and inorganic matter that accumulates in a loose, unconsolidated form on the bottom of natural waters.

Sediment delivery: Contribution of transported sediment to a particular location or part of a landscape.

Sediment production: Delivery of colluvium or bedrock from hillslope to stream channel. The production rate is evaluated as the sum of the rates of colluvial bank erosion and sediment transport across channel banks.

Sediment yield: Amount of sediment passing a particular point (e.g., discharge point of the basin) in a watershed per unit of time.

Sedimentation: Process of deposition of waterborne or windborne sediment or other material; also refers to the infilling of bottom substrate in a waterbody by sediment (siltation).

Sheet erosion: Also Sheetwash. Erosion of the ground surface by unconcentrated (i.e. not in rills) overland flow.

Stream restoration: Various techniques used to replicate the hydrological, morphological, and ecological features that have been lost in a stream due to urbanization, farming, or other disturbance.

Suspended solids or load: Organic and inorganic particles (sediment) suspended in and carried by a fluid (water). The suspension is governed by the upward components of turbulence, currents, or colloidal suspension. Suspended sediment usually consists of particles <0.1 mm, although size may vary according to current hydrological conditions. Particles between 0.1 mm and 1 mm may move as suspended or be deposited (bedload).

Thalweg: Deepest part of a stream channel.

Total Maximum Daily Load or TMDL: The calculated maximum permissible pollutant loading to a water body at which water quality standards can be maintained.

Turbidity: A measure of opacity of a substance; the degree to which light is scattered or absorbed by a fluid.

Waste: Sewage, industrial wastes, oil field wastes, and all other liquid, gaseous, solid, radioactive, or other substances which may pollute or tend to pollute any waters of the State.

Wasteload allocation (WLA): The portion of a receiving water's loading capacity attributed to or assigned to point sources of a pollutant.

Water Quality Standards: The criteria and requirements set forth in *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*. Water quality standards are standards composed of designated present and future most beneficial uses (classification of waters), the numerical and narrative criteria applied to the specific water uses or classification, and the Mississippi antidegradation policy.

Water quality criteria: Elements of State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports the present and future most beneficial uses.

Waters of the State: All waters within the jurisdiction of this State, including all streams, lakes, ponds, wetlands, impounding reservoirs, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, situated wholly or partly within or bordering upon the State, and such coastal waters as are within the jurisdiction of the State, except lakes, ponds, or other surface waters which are wholly landlocked and privately owned, and which are not regulated under the Federal Clean Water Act (33 U.S.C.1251 et seq.).

Watershed: The area of land draining into a stream at a given location.

ABBREVIATIONS

AGNPS..... Agricultural Nonpoint Source Pollutant Loading Model

ARS ..... Agricultural Research Service

BOD_5 ..... Biochemical Oxygen Demand - 5 Day

BMP ..... Best Management Practice

CONCEPTS .....Conservational Channel Evolution and Pollution Transport System

CWA .....Clean Water Act

CWPRU .....Channel and Watershed Processes Research Unit

DA .....Drainage Area

DEM ..... Digital Elevation Model

DMR.....Discharge Monitoring Report

EPA ..... Environmental Protection Agency

GIS .....Geographic Information System

HUC ..... Hydrologic Unit Code

LA..... Load Allocation

MDEQ ..... Mississippi Department of Environmental Quality

MFC .....Mississippi Forestry Commission

MOS..... Margin of Safety

MRLC..... Multi-Resolution Land Characterization

NPDES .....National Pollution Discharge Elimination System

NPS .....Non-Point Source

NRCS .....Natural Resource Conservation Service

RF3.....Reach File 3

USGS.....United States Geological Survey

USLE..... Universal Soil Loss Equation

WLA.....Waste Load Allocation

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